PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Form PCT/IPEA/416
CANEEDLMAYEX		

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/HU2004/000083	11.08.2004	21.08.2003

International Patent Classification (IPC) or national classification and IPC
A61M5/30

Applicant
LINDMAYER, S. Istvan

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 17 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
03.08.2005	25.11.2005

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/HU2004/000083

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-13	received on 03.08.2005 with letter of 01.08.2005

Claims, Numbers

1-5	received on 03.08.2005 with letter of 01.08.2005

Drawings, Sheets

1/2, 2/2	received on 03.08.2005 with letter of 01.08.2005

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/HU2004/000083

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-5
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-5
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-5
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:
   D1: GB 681098
   D2: WO 03066143
   D3: WO 03000319
   D4: US 4722728
   D5: US2002055712

Novelty Article 33(2) PCT and Inventive Step Article 33(3) PCT

2. The present application does appear to meet the criteria of Article 33(1) PCT, because **the subject-matter of claims 1-5 is new and inventive** in the sense of Article 33(2) and (3) PCT.

   The document D1 is regarded as being the closest prior art to the subject-matter of claim 1 and discloses (the references in parentheses applying to this document) a a needleless injection device comprising (figures 1-13):

   - a lower part (36)
   - an upper part (34)
   - energy store units (90,56)
   - a start unit (90)
   - supplementary units (56)
   - lock means (74,80)
   - means for releasing the lock (76)
   - a long tube of the lower part (36)

   The subject-matter of claim 1 therefore differs from this known hypodermic syringe in that:

   - a long tube of the lower part, with external thread, stretches into the upper part and at the bottom fits into the short internal thread of the adjoining part of the upper part

- the lower part is attached to the upper part revolving manner, moving in a telescopic way, and results the tension state of the energy store units
- at least one start unit capable of storing minimum 60%, preferably 80-90% of the total discharge energy, with the reversible elastic distorsion at max. 25%, practically 15-20% of the internal lenght of the agent cartridge
- the start unit is a bundle of polyurethane springs fitted inside the device in a separate case, at stretching it is joined with the mean transferring the strechting power, preferably with the lock mechanism, by a spacer, having no contact with other energy store units

The problem to be solved by the present invention may therefore be regarded as how to enable the optimal store amount of energy and to release it always at the optimal time and speed suitable.

No document of the search report discloses a such needleless injection device.
It is not evident to have to modify the needleless injection device of document D1 to solve these problems. There is no indication in the document of the search report to use the mean for stretching the springs and the start unit composed by polyurethane spings.

Therefore the subject matter of claims 1-5 is considered to meet the requirement of Article 33 (1) PCT in respect of novelty and inventive step.

NEEDLELESS INJECTION DEVICE AND CARTRIDGES

The invention relates to a needleless injection device with a lower part receiving an agent cartridge and an upper part providing the energy needed for injection; the upper part contains energy store units, namely start unit(s) and supplementary unit(s), capable of elastic form-change; furthermore, the device has a lock maintaining the tension of the energy store units and components to release the lock; and the invention also relates the agent cartridge.

An advantage of the needleless solutions is that no infection is possible through multiple use of needles or defective sterilisation. Another advantage is that agent injection with a needleless device causes a twenty times smaller fracture (an injecton hole of cc. 0.008 mm^2) on the epidermis than the smallest needle ever used before. Consequently, the needleless solution causes the patient less pain. The agent is prepared in a sterile cartridge, which precisely fits into the injection device. The thrust needed for the injection of the agent is supplied by the expansion of compressed gas as in US 4,913.699 patent, or a mechanical spring structure as used in US 5,190.523 patent. Also known is a solution in which the injection energy is given by the explosion of a suitable detonating charge. The known needleless injection devices usually comprise two parts. One serves for receiving the agent cartridge, while the other is the energy storage unit, where the spring, the compressed gas container, or the explosive capsule is situated. These devices are operated in a way that in the case of a spring, the spring is flexed, and locked in this position. The agent cartridge is inserted, which also contains the piston to discharge the agent. Then the device is positioned on the skin surface with the discharge hole down, and release the energy stored in the energy storage unit. If it works with a spring, the lock is released, in other solutions, the gas capsule is opened, or the explossive is detonated. In each case the released energy thrusts the piston powerfully forwards, and injects the agent stored in the cartridge into the skin, or through the skin into the hypodermic tissues or the muscles. As is known, giving a traditional injection, the doctor thrusts the needle into the desired point with rapid movement, thus opening the way in for the agent. Then, with a moderate push of the syringe, they cause a relatively slow influx of the agent, otherwise

Specification U.K. 681.098 gives a solution to eliminate most of this problems. It uses a two-stage jet with a hard spring start unit, and separated from it a soft spring for the following injection. For compressing the springs the device is provided with a pull rod, what they have to pull along the long axis of the device with the help of the knob on the top of it.

The development efforts are orientated towards an energy storage and release structure which is enabled to store optimal amount of energy and to release it always at the optimal time and speed suitable for fulfilling the task. Too low impact is unsuitable since it causes a partial or complete failure to inject the agent. Perhaps due to a loss or too low a level of energy, the cartridge is not emptied entirely. One of the most important parts of the device is the discharge hole, the precise measure and ideal profile cannot be satisfactorily produced from glass or metal. Thus, for discharge holes, glass cartridges receive metal inlays, metal cartridges receive glass or semi-precious stones (e.g. saphire or ruby) inlays, the fitting of which into the cartridge raises solidity, while inside the cartridge, owing to turbulencies in the joining and contact zones of the metal and the glass, hydrodynamic problems. Although the devices known from patents and available on the market meet the elementary health and technical requirements, they cannot manage the above described quality services. They are also unable to provide the affordable sales price acceptable with disposable devices.

The goal of the invention is the development of a needleless injection device with an agent cartridge eliminating the abovementioned drawbacks, on a reliable technical level, using simple production technology and a more favourable, economical price standard, facilitating disposability.

The invention is based on the recognition that the injection of the agent in/under the skin or in the muscles can be carried out without an impact if the energy released in the first few tenth seconds has enough power to thrust the entry channel through the epidermis immediately. In such a solution the piston in the agent cartridge is in continuous contact with the piston rod transferring the energy, and, unlike the known structures, it is not necessary that the piston rod be first accelerated by the released energy, and use this speed to blow into the agent cartridge piston.

tive recognition we may produce the discharge hole from the own material of cartridge consider its size, profile and precision equal with the metal discharge hole. This solution has the advantage that there is no any break-line on the inner surface of the cartridge because there are no two different material adjoining one with other. Thus we may avoid the turbulence of liquid stream, and achieve an energy-spare, consequently smaller size and price of the device. Further we may also avoid the danger of disengage of the inlay, and the price of the cartridge is essentially lower than of the variant produced with metal inlay discharge hole.

The inventive solution based on the said recognition is a needleless injection device with a lower part receiving an agent cartridge and an upper part providing the energy needed for injection; the upper part contains energy store units, namely start unit(s) and supplementary unit(s), capable of elastic form-change; furthermore, the device has a lock maintaining the tension of the energy store units and components to release the lock.

The device may characterized by that a long tube section of the lower part, with external thread stretches into the upper part and at the bottom fits into the short internal thread of the adjoining part of the upper part, thus the lower part is attached to the upper part revolving manner, moving in a telescopic way, and results the tension state of the energy store units; at least one start unit, capable of storing min. 60%, preferably 80-90% of the total discharge energy (pressure), with the reversible elastic distortion at max. 25%, practically 15-20% of the internal length of the agent cartridge; wherein the start unit is a bundle of polyurethane springs fitted inside the device in a separate case, at stretching it is joined with the mean transferring the stretching power, preferably with the lock mechanism, by a spacer, having no contact with other energy store units, namely with supplementary unit(s).

The device preferably may characterized by that the supplementary unit(s) are volute springs, comprising 2-8, preferably 4-5 volute springs fitted coaxially in each other, surrounding the geometric axis of the upper part, or using more supplementary units, these are positioned symmetrically around the geometric axis.

into the upper part 2, and its external part, integral with the latter, surrounds the adjoining part 43 of the upper part 2 as a case. The tube 13 of the lower part 1, which stretches into the upper part 2, has an external thread 14, that fits into the internal thread 44 ensuring the contact. On the external surface of the lower part 1 there are wings to provide easy grip when turning the lower part 1. The mentioned adjoining part 43 of the upper part 2 is a hollow case, which narrows down to the size of the tube 13 of the lower part 1 only at the bottom, where there is a sufficient number of internal threads 44. The number of internal threads is just enough to hold the internally threaded tube13 of the lower part 1 safely. On turning the lower part 1, the tube 13, clutching the internal thread 44 of the adjoining part 43 of the upper part 2 penetrates into the upper part 2, while the external part slips upon it (Figure 1.). When turned reversely, it withdraws (Figure 2.). In such a way, clasped on each other with threads, the lower part 1 and and upper part 2 move into each other and open up in a telescopic way. Inside the adjoining part 43 of the upper part 2 is the lock mechanism 4 (Figure 6.). The 4 lock mechanism is a closed cylindrical springy cup 41 precisely fitting into the upper part 2, in which a socket moves like a piston, pushed by a locking spring towards the cover of the springy cup 41. On the cylindrical surface of the socket, distributed uniformly around, there are three or four pockets, and in the cylindrical wall of the springy cup there is an equal number of perforations distributed in a circulat fashion. In every pocket and overlapping perforation there is a locking ball. When the locking spring is in tension, the pockets of the socket are overlapping the perforations of the springy cup 41. Since the locking spring pushes the socket upwards, the poskets of the socket, optimally shaped with an evolvent profile, press the locking balls on the internal surface of the upper part 2, but the balls prevent the socket from moving up to the top of the springy cup 41. When the springy cup 41 moves upwards inside the adjoining part 43 of the upper part 2, it reaches a cross section, where on the inside surface of the upper part 2, there is an equal number and distribution of locking pockets as in the springy cup 41 (Figure 8.). As soon as the springy cup 41 arrives there, the locking balls spring into the pockets, which stops the free movement of the springy cup 41. The locking spring pushes the socket against the top of the springy cup, which stops the balls from leaving the pockets. This holds the springy

eral, optimally 4-6 volute springs, inserted into each other coaxially. The 3-5 identical supplementary units 35 surround the axis of the device 20 and the spacer 33 cover in equal distribution. The profile of the spacer has as many concave elliptic grooves running around the outside surface as the number of supplementary units around (Figure 9.). The ribs between the concave surfaces also serve as stiffeners. Another possible version is where there is only one supplementary unit 35 and the spacer 33 stands in the common centre of the coaxial volute springs. According to the experience, this solution provides a more limited possibility of regulation in terms of a practical selection and combination of the springs. The possible movement limits of the springy cup 41 in the adjoining part 43 of the upper part 2 go from near the internally threaded 44 bottom part of the adjoining part 43 as far as the locked position of the springy cup 41. The difference between these two extreme positions of the springy cup 41 (more exactly the two positions of the cover of the springy cup 41) define the space the tension and relaxed position of the energy storing supplementary units 35 can use inside the upper part 2 (Figures 2. and 3.). To select the length of the spacer 33 one has to define to what extent that is how many millimetres the start unit 31 in the case 32 has to be pressed for the tension. The length of the spacer has to be selected so that it be lifted by the springy cup 41 this much before reaching the locked position, that is, reach in so much deeper than the locked end positino of the springy cup 41. The release mechanism 5 is responsible for ceasing the locked position and releasing the stored energy. The 5 releasing mechanism is at the top of the upper part 2. It is a release button 51, which can be pressed against a mild safety spring, and an adjoining release rod. For the release rod 52 there is a channel as far as the socket in the springy cup 41. At the top of the case 32 and the cover of the springy cup 41, there are perforations. The release rod 52 goes along these and the centre of the ring-shaped start unit 31 and the hole in the spacer 33. On pressing the release button 51, the socket is pressed down as far as the locking balls, which thus progress from the locking pockets to the socket pockets, which ceases the locked position. The release button 51 is surronded with a hard protective collar to prevent unintended pressure. Accordig to another solution, a 30-60° turn of the re-

lock, the start unit 31 and the supplementary units 35 break free from the blockade together, jointly poroducing the 600 bar pressure in the agent cartridge required for opening the injection channel. With this, the role of the powerful start unit 31 ends. Not because it has transferred all its energy, but because the starter stay plate 34 has reached the bottom of the case 32 and is physically blocked in further relaxing form change (Figure 5.). As a result of continuous downward movement, the cover of the springy cup 41 leaves the spacer 33. Thus, no more energy transfer is possible by the start unit 31. This structure and arrangement ensures that the start unit 31 can operate only on linear section, between 20-60% stretch rates, which is adequately designable and measurable. Acording to experience, a more powerful tension or relaxation of the springs would result in permanent distortion. Furthermore, it can be ensured that the power opening the injecction channel should appear already in the first 0.2 sec., without an inconvenient acceleration of the injection. In our sample the full length of the cartridge 8 is 20 mm, out of which only 3-5 mm is necessary for opening the channel. Only the supplementary units 35 of likewise designed pressure continue work. With this solution, the progress and timing of the manual injection performed by a health professional can be almost perfectly monitored.

It is to be stressed that this invention fundamentally differs both in theory and practice from known solutions including known solutions applying combinations of different springs. Merely by the simultaneous use of springs of different characteristics, the task is not solved, because the start and following continuous stages are not appropriately separated in time. At these earlier versions the pressure of the start stage cannot be put high enough, because later it would interfere with the injection at a moderated speed. Thus, the impact on the piston cannot be missed in order to open the injection channel. This is fully eliminated in our solution. On the other hand, in earlier solutions, since at tension energy storing is done in the whole energy storage unit simultaneously, the produced energy cannot be differentiated in the complex system to the different energy storing components. At this invention, as obvious from the description and the plans, not only the measure and time of energy transfer are separated as regards the start unit 31 and the supplementary units 35, but also the energy-intake, the tension.

of the cartridge 8. Unlike the known earlier solutions, there is no need to apply alien materials like metal for the discharge hole 82, which, as extra material and producing cost, would dramatically raise the price of the cartridge 8. In the known earlier solutions it was impossible to generate a discharge hole of the required small diameter from the cartridge's own material, but especially not with ensuring the precise position and orientation. As the invented product, manufactured from die-cast plastic, proves, the task can be fulfilled successfully. In such a way a brand new, technically more advantageous and cheaper product is born as compared with known versions.

The patent description proves that this invention is a new, genuine solution, which entirely meets all the objectives. It perfectly follows the ideal process performed with manual injections with needles. Unlike earlier known devices with energy storage applying complex spring mechanisms, this solution safely separates the stage of punching the epidermis in the first moment from the moderate, seamless injection of the agent. All this is realised through a simple mechanism with reliable operation. Besides the device, the fitting agent cartridge is also a more practical, new solution. The uniform conical shape of the cartridge and the case ensures the precise, safe blocking of the two components through a simple concept. The discharge hole in the cartridge is die-cast from the cartridge's own material, which is extremely practical technically and financially, and, as an invention, it is completely new. The inventions summarised in the points of application each mean a significant progress in the field. Assembled, they are especially successful in supporting each other's advantages and achievements.

5.) The device according to any of claims 1 - 4 characterized by that the discharge hole (82) of the agents cartridge's (8) is situated precisely in the axis of symmetry of the cartridge's (8).

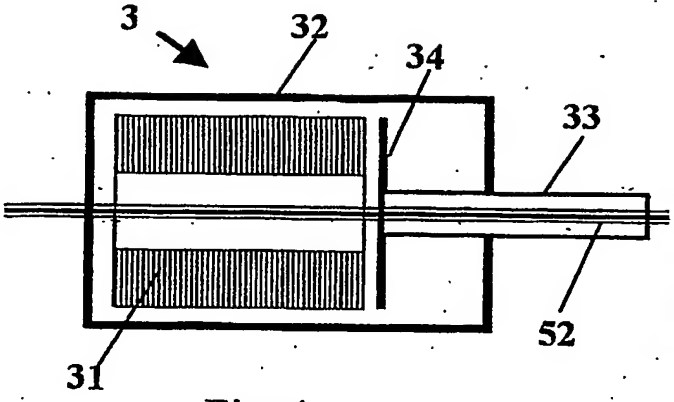

Fig. 4

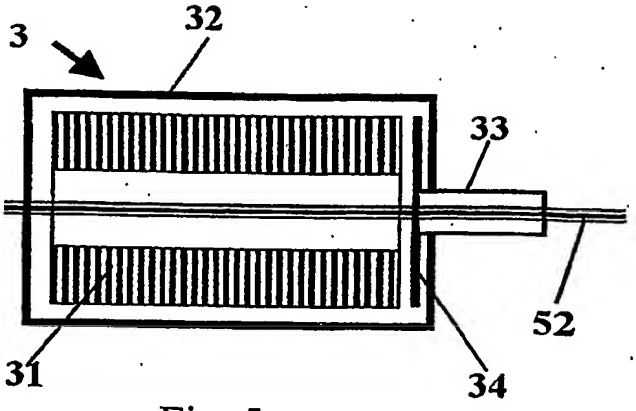

Fig. 5

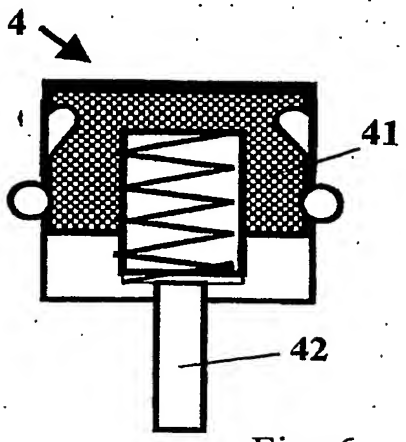

Fig. 6

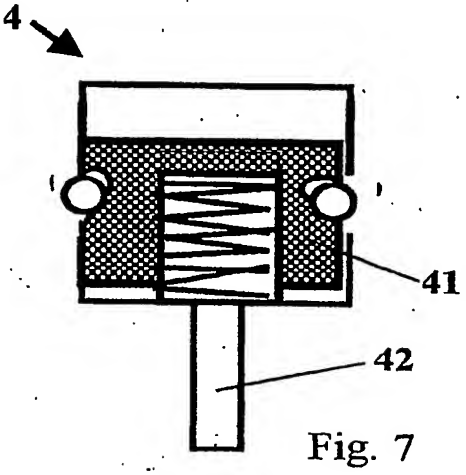

Fig. 7

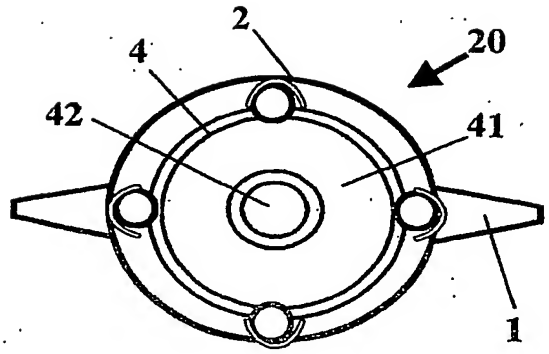

Fig. 8

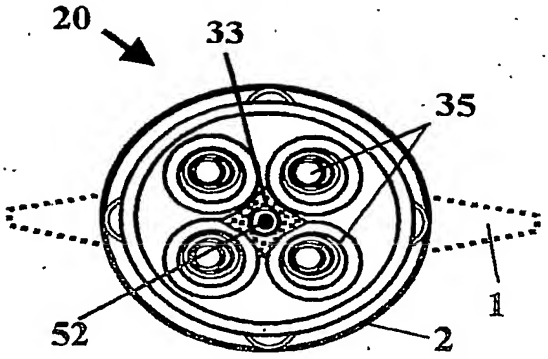

Fig. 9